

IN THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A lithographic projection apparatus comprising:
a radiation system which supplies a projection beam of radiation;
a first object table constructed and arranged to hold a mask;
a second object table constructed and arranged to hold a substrate;
an imaging projection system configured to image irradiated portions of the mask onto target portions of the substrate;
first and second balance masses disposed along opposite sides of ~~the first object table~~ at least one of the object tables; and
first and second motors configured to move the at least one of the object tables ~~first object table~~, each motor having two cooperating electromagnetic members, a first of the members being operatively associated with the at least one of the object tables ~~mounted to the first object table~~ and a second of the members being operatively associated with ~~mounted to~~ at least one of the first and second balance masses, wherein said first and second balance masses are substantially free to move in at least a first direction to provide balancing to the ~~first object table~~ at least one of the object tables, and
wherein the at least one of the object tables is supported by a support structure that is substantially independent from the first and second balance masses.
2. (Currently Amended) The apparatus of claim 1, wherein said first direction is substantially parallel to a direction of motion of the ~~first object table~~ at least one of the object tables.
3. (Currently Amended) The apparatus of claim 1, wherein said ~~first and second balance masses have parallel planar upper surfaces~~ support structure has a planar upper surface.
4. (Currently Amended) The apparatus of claim 3, wherein the ~~first object table~~ at least one of the object tables is provided with bearings, said bearings being configured to act on said planar ~~surfaces~~ surface to allow said ~~first object table~~ at least one of the object tables to

move substantially without friction relative to the ~~first and second balance masses~~ support structure.

5. (Currently Amended) The apparatus of claim 1, wherein said ~~bearings include~~ apparatus is provided with actuators configured to move said ~~first object table~~ at least one of the object tables in a direction substantially perpendicular to said first direction and to rotate said ~~first object table~~ at least one of the object tables relative to at least said first direction.

6. (Currently Amended) The apparatus of claim 1, further ~~comprises~~ comprising: a base structure; ~~and parallel rails coupled to said base structure, said parallel rails having a~~ substantially flat horizontal upper ~~surfaces~~ surface, wherein said first and second balance masses are supported in a second direction substantially perpendicular to said first direction by a plurality of bearings acting upon said substantially flat horizontal upper ~~surfaces~~ surface.

7. (Original) The apparatus of claim 6, wherein said first and said second balance masses are free to move in said first direction over a relatively wide range of motion.

8. (Original) The apparatus of claim 6, wherein said first and second balance masses are free to move in a third direction substantially perpendicular to said first and said second directions, and the movement of said first and second balance masses in the third direction is provided by compliant bearings acting against substantially vertical walls of said parallel rails.

9. (Original) The apparatus of claim 6, wherein independent movement of the bearings acting upon the horizontal upper surfaces of the parallel rails provides rotational movement of said first and second balance masses around said first direction and said third direction.

10. (Original) The apparatus of claim 6, wherein said bearings have a low stiffness in said second direction such that at least one of said first and said second balance masses is substantially free to move in said second direction.

11. (Currently Amended) The apparatus of claim 1, wherein a mass of each of said first and second balance masses is 2 to 10 times larger than a mass of said ~~first object table~~ at least one of the object tables.

12. (Currently Amended) The apparatus of claim 1, wherein a center of gravity of said first and second balancing masses and a center of gravity of said ~~first object table~~ at least one of the object tables are located at less than 100 mm apart from each other in a direction perpendicular to said first direction.

13. (Currently Amended) The apparatus of claim 1, wherein said ~~first object table~~ at least one of the object tables is driven in said first direction by the first motor acting between the ~~first object table~~ at least one of the object tables and the first balance mass and by the second motor acting between the first object table and the second balance mass.

14. (Original) The apparatus of claim 1, wherein the first and second motors comprise linear motors, armatures mounted to the ~~first object table~~ at least one of the object tables, and an elongate stator mounted to each of the first and second balance masses.

15. (Currently Amended) The apparatus of claim 13, wherein said ~~first object table~~ at least one of the object tables is movable in a direction substantially perpendicular to said first direction by a third motor, and a line of action of said third motor passes through at least a position of a center of gravity of said ~~first object table~~ at least one of the object tables in the first direction.

16. (Original) The apparatus of claim 1, further comprising a drift control which limits drift of the first and second balance masses.

17. (Currently Amended) The apparatus of claim 16, wherein the drift control comprises a servo control system and an actuator which applies forces to the first and second balance masses biasing a combined center of gravity of the first and second balance masses and the ~~first object table~~ at least one of the object tables to a desired position.

18. (Original) The apparatus of claim 17, wherein the drift control has a servo bandwidth at least a factor of five lower than a lowest resonance frequency of the first and second balance masses and a base of the apparatus.

19. (Original) The apparatus of claim 16, wherein the drift control comprises an active system.

20. (Original) The apparatus of claim 16, wherein the drift control comprises a negative-feedback servo system.

21. (Original) The apparatus of claim 16, wherein the drift control comprises a passive system.

22. (Original) The apparatus of claim 16, wherein the drift control comprises at least one spring.

23. (Amended) ~~The apparatus of claim 1, further comprising a third balance mass having a substantially planar upper surface, wherein said first object table is positioned over said substantially planar surface of said third balance mass~~ A lithographic projection apparatus comprising:

a radiation system which supplies a projection beam of radiation;

a first object table constructed and arranged to hold a mask;

a second object table constructed and arranged to hold a substrate;

an imaging projection system configured to image irradiated portions of the mask onto target portions of the substrate;

first and second balance masses disposed along opposite sides of at least one of the object tables; and

first and second motors configured to move the at least one of the object tables each motor having two cooperating electromagnetic members, a first of the members being operatively associated with the at least one of the object tables and a second of the members being operatively associated with at least one of the first and second balance masses, wherein said first and second balance masses are substantially free to move in at least a first direction to provide balancing to the at least one of the object tables, and

wherein the at least one of the object tables is supported by a third balance mass that is substantially independent from the first and second balance masses.

24. (Currently Amended) The apparatus of claim 1, further comprising a short stroke frame ~~positioned over said first and said second balance masses and supported by a plurality of bearings~~ said support structure.

25. (Currently Amended) The apparatus of claim 24, wherein said short stroke frame is movable in the first direction and a second direction perpendicular to said first direction ~~and rotatable around a third direction perpendicular to said first and said second directions.~~

26. (Currently Amended) The apparatus of claim 24, wherein the ~~first object table~~ at least one of the object tables is driven relative to said short stroke frame ~~to position said mask~~ in six degrees of freedom.

27. (New) The apparatus of claim 1, wherein the at least one of the object tables comprises the first object table.

28. (New) The apparatus of claim 1, wherein the at least one of the object tables comprises the second object table.

29. (New) The apparatus of claim 1, wherein the first of the cooperating electromagnetic members comprises a coil and the second of the cooperating electromagnetic members comprises a magnet.

30. (New) The apparatus of claim 1, wherein the first of the cooperating electromagnetic members comprises a magnet and the second of the cooperating electromagnetic members comprises a coil.

31. (New) The apparatus of claim 1, wherein the first and second motors are configured to exert forces on said first and second balance masses in opposite directions to effect rotation of said at least one of the object tables;

32. (New) The apparatus of claim 1, wherein the first and second motors are configured to exert forces on said first and second balance masses in opposite directions to effect rotation of said at least one object table around an axis perpendicular to a planar surface of said support structure.

33. (New) A lithographic projection apparatus comprising:
a radiation system which supplies a projection beam of radiation;
a first object table constructed and arranged to hold a mask;
a second object table constructed and arranged to hold a substrate;
an imaging projection system configured to image irradiated portions of the mask onto target portions of the substrate;

first and second balance masses disposed along opposite sides of at least one of the object tables; and

first and second motors configured to move the at least one of the object tables, each motor having two cooperating electromagnetic members, a first of the members being operatively associated with the at least one of the object tables and a second of the members being operatively associated with at least one of the first and second balance masses, wherein said first and second balance masses are substantially free to move in at least a first direction to provide balancing to the at least one of the object tables, and

wherein the at least one of the object tables is supported by a support structure that is independent from the first and second balance masses.

34. (New) The apparatus of claim 33, wherein the support structure has a horizontal upper surface.

35. (New) The apparatus of claim 33, wherein the support structure and the balance masses are supported on a common base frame.

36. (New) The apparatus of claim 33, wherein the at least one of the object tables is supported by air bearings.

37. (New) The apparatus of claim 36, wherein the common base frame is supported on vibration isolators.

38. (New) The apparatus of claim 33, wherein each motor further comprises a longstroke positioning module and a short stroke positioning module.

39. (New) The apparatus of claim 33, wherein the first and second motors are configured to exert forces on said first and second balance masses in opposite directions to effect rotation of said at least one of the object tables;

40. (New) The apparatus of claim 33 wherein the first and second motors are configured to exert forces on said first and second balance masses in opposite directions to effect rotation of said at least one object table around an axis perpendicular to said horizontal upper surface.

41. (New) A lithographic projection apparatus comprising:
a radiation system which supplies a projection beam of radiation;
a first object table constructed and arranged to hold a mask;
a second object table constructed and arranged to hold a substrate;
an imaging projection system configured to image irradiated portions of the mask onto target portions of the substrate;

first and second balance masses disposed along opposite sides of at least one of the object tables; and

first and second motors configured to move the at least one of the object tables, each motor having two cooperating electromagnetic members, a first of the members being operatively associated with the at least one of the object tables and a second of the members being operatively associated with at least one of the first and second balance masses, wherein said first and second balance masses are substantially free to move in at least a first direction to provide balancing to the at least one of the object tables, and

wherein the at least one of the object tables is at least partly supported by a support structure that is different from the first and second balance masses.

42. (New) The apparatus of claim 41, wherein the support structure has a planar horizontal upper surface.

43. (New) The apparatus of claim 41, wherein the support structure and the balance masses are supported on a common base frame.

44. (New) The apparatus of claim 41, wherein the at least one of the object tables is supported by air bearings.

45. (New) The apparatus of claim 43, wherein the common base frame is supported on vibration isolators.

46. (New) The apparatus of claim 41, wherein each motor further comprises a coarse positioning module and a fine positioning module.

47. (New) The apparatus of claim 41, wherein the first and second motors are configured to exert forces on said first and second balance masses in opposite directions to effect rotation of said at least one of the object tables.

48. (New) Apparatus of claim 47, wherein said rotation is around an axis parallel to the projection beam of radiation.

49. (New) A lithographic projection apparatus comprising:
a radiation system which supplies a projection beam of radiation;
a first object table constructed and arranged to hold a mask;
a second object table constructed and arranged to hold a substrate;
an imaging projection system configured to image irradiated portions of the mask onto target portions of the substrate;

first and second balance masses disposed along opposite sides of at least one of the object tables;

a support structure for supporting the at least one of the object tables; and

first and second motors configured to move the at least one of the object tables, each motor having two cooperating electromagnetic members, a first of the members being operatively associated with the at least one of the object tables and a second of the members being operatively associated with at least one of the first and second balance masses, wherein said first and second balance masses are substantially free to move in at least a first direction to provide balancing to the at least one of the object tables.

50. (New) The apparatus of claim 49, wherein the support structure has a planar horizontal upper surface.

51. (New) The apparatus of claim 49, wherein the support structure and the balance masses are supported on a common base frame.

52. (New) The apparatus of claim 49, the at least one of the object tables is supported by air bearings.

53. (New) The apparatus of claim 51, wherein the common base frame is supported on vibration isolators.

54. (New) The apparatus of claim 49, wherein each motor further comprises a longstroke positioning module and a short stroke positioning module.

55. (New) The apparatus of claim 49, wherein the first and second motors are configured to exert forces on said first and second balance masses in opposite directions to effect rotation of said at least one of the object tables.

56. (New) The apparatus of claim 1, further comprising: a base structure; and parallel rails coupled to said base structure, said parallel rails having substantially flat horizontal upper surfaces, wherein said first and second balance masses are supported in a second direction substantially perpendicular to said first direction by a plurality of bearings acting upon said substantially flat horizontal upper surfaces.

57. (New) A lithographic projection apparatus comprising:
a radiation system which supplies a projection beam of radiation;
a first object table for holding a mask;
a second object table for holding a substrate;
an imaging projection system which images irradiated portions of the mask onto target portions of the substrate;
a balanced object table positioning system which positions at least one of said object tables;
first and second balance masses;

a support structure for supporting the at least one of the object tables
a bearing, supporting each of said first and second balance masses such that they are substantially free to translate in at least a first direction;
actuators which act between said at least one of the object tables and said first and second balance masses to rotate said at least one of the object tables about an axis perpendicular to said first direction, and
a drift control which limits drift of said balance masses constructed and arranged to apply a biasing force to the balance masses such that the combined center of mass of the balance masses, the object table positioning system and the at least one of the object tables is biased towards a desired position.

58. (New) A lithographic projection apparatus comprising:
a radiation system which supplies a projection beam of radiation;
a first object table for holding a mask;
a second object table for holding a substrate;
an imaging projection system which images irradiated portions of the mask onto target portions of the substrate;
first and second balance masses;
a support structure for supporting at least one of the object tables;
a balanced object table positioning system which positions said at least one of said object tables and at least partially supported by at least one of the balance masses;
a bearing for supporting each of said first and second balance masses such that they are substantially free to translate in at least a first direction; and
actuators being arranged to exert forces on said first and second balance masses in opposite directions to effect rotation of said at least one of said object tables.

59. (New) A lithographic projection apparatus comprising:
a radiation system which supplies a projection beam of radiation;
a first object table for holding a mask;
a second object table for holding a substrate;
an imaging projection system which images irradiated portions of the mask onto target portions of the substrate;
first and second balance masses;
a support structure for supporting at least one of the object tables;

a balanced object table positioning system which positions the at least one of said object tables and at least partially supported by at least one of the balance masses;

a bearing, supporting each of said first and second balance masses such that they are substantially free to translate in at least a first direction; and

actuators being arranged to exert forces on said first and second balance masses in opposite directions to effect rotation of said at least one of the object tables, said actuators being constructed and arranged such that forces applied by the actuators onto the at least one of the object tables result in equal reaction forces being applied by the actuators on the balance masses.

60. (New) A lithographic apparatus comprising:

a patterning means;

an object table constructed and arranged to hold a substrate;

an imaging projection system configured to image irradiated portions of the patterning means onto target portions of the substrate;

first and second balance masses disposed along opposite sides of the object table;

a support structure for supporting the object table; and

first and second motors configured to move the object table, each motor having two cooperating electromagnetic members, a first of the members being operatively associated with the object table and a second of the members being operatively associated with at least one of the first and second balance masses, wherein said first and second balance masses are substantially free to move in at least a first direction to provide balancing of the object table.

61. (New) A lithographic apparatus comprising:

a radiation system which supplies a projection beam of radiation;

a first object table constructed and arranged to hold a patterning means;

a second object table constructed and arranged to hold a substrate;

a projection system configured to image irradiated portions of the patterning means onto target portions of the substrate;

first and second balance masses disposed along opposite sides of at least one of the object tables;

a support structure for supporting the at least one of the object tables; and

first and second motors configured to move the at least one of the object tables, each motor having two cooperating electromagnetic members, a first of the members being operatively associated with the at least one of the object tables and a second of the members

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being operatively associated with at least one of the first and second balance masses, wherein said first and second balance masses are substantially free to move in at least a first direction to provide balancing to the at least one of the object tables.